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SOME ENCOMIUMS

UPON THE

EXCELLENT TREATISE OF CHEMISTRY, BY BERZELIUS;

ALSO

Objections to his Nomenclature, and Suggestions respecting a Substitute, deemed preferable, in a Letter to Professor Silliman.

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85-11

Philadelphia, June, 1834.

MY DEAR SILLIMAN,

I have already apprized you, that last year I had the honour to receive from the celebrated Berzelius, six volumes of his admirable treatise of Chemistry; to which, during the last summer, I gave much time, in order to avail myself of the vast fund of useful practical knowledge which it contains. I am of opinion that to adepts in the science, this treatise is the most interesting and instructive compilation of chemical knowledge which has ever issued from the press. It comprises much matter for which Chemistry is indebted entirely to the genius, skill, and industry of the author, while scarcely any subject in it is so treated, as not to create a renovated interest in the reader, however previously familiar with the science.

Sweden may with reason be proud of her Scheele, her Bergman, and her Berzelius. The last, but not the least, of these great chemists, aided by an Herculean intellect, and commencing at the point at which his predecessors terminated their glorious career, may be considered as possessing attainments which have never been excelled. Yet the sun is not without spots, nor is Berzelius without errors; unless indeed, those which I have ascribed to him, are phantoms of my own intellectual vision.

I concur with those chemists who consider the relation ascertained by Berzelius, between the quantities of oxygen in oxybases, and in oxacids, as a necessary consequence of the laws of combination, on which the Daltonian theory has been founded. I conceive also that the interesting facts which demonstrate the existence of the relation alluded to, would be more easily understood and remembered, if referred to the theory of atoms, than when made the basis of his doctrine of capacities for saturation, and of the numbers by which those capacities are expressed.

Moreover, I do not approve of his nomenclature. This is a subject highly interesting to me at this time. The last edition of my text book is exhausted, and in publishing a new edition I shall be obliged either to adopt the nomenclature of Berzelius, or to adhere

to that now generally used, with such improvements as may seem to me consistent with its principles.

I will proceed to state my objections to the Berzelian nomenclature, and to suggest the language which I would prefer. I should be glad if the promulgation of my opinions should call forth remarks which may enable me to correct in due season, any errors into which I may have fallen. I regret the necessity of making a final election, before submitting my objections to Berzelius himself, whose disapprobation it would grieve me much to incur.

My apology will be found in the adage—"Amicus Plato, sed magis amica veritas." Besides, if my opinions are incorrect, they will only react upon their author. The productions of Berzelius stand deservedly too high in public favour to be reached by ill founded criticism.

The most striking feature in the nomenclature of Berzelius, is the formation of two classes of bodies; one class called "*halogene*," or salt producing, because they are conceived to produce salts directly; the other called "*amphigene*," or both producing, being productive both of acids and bases, and of course indirectly of salts. To render this division eligible, it appears to me that the terms acid, base, and salt, should, in the first place, be strictly defined. Unfortunately there are no terms in use, more broad, vague, and unsettled in their meaning. Agreeably to the common acceptance, chloride of sodium is pre-eminently entitled to be called a salt; since in common parlance, when no distinguishing term is annexed, salt is the name of that chloride. This is quite reasonable, as it is well known that it was from this compound, that the genus received its name. Other substances, having in their obvious qualities some analogy with chloride of sodium, were, at an early period, readily admitted to be species of the same genus; as, for instance, Glauber's salt, Epsom salt, sal ammoniac. Yet founding their pretensions upon similitude in obvious qualities, few of the substances called salts, in the broader sense of the name, could have been admitted into the class. *Insoluble* chlorides have evidently, on the score of properties, as little claim to be considered as salts, as *insoluble* oxides. Luna cornea, plumbum corneum, butter of antimony, and the fuming liquor of Libavius, are the appellations given respectively to chlorides of silver, lead, antimony, and tin, which are quite as deficient of the saline character as the corresponding compounds of the same metal with oxygen. Fluoride of calcium (fluor spar) is as unlike a salt as lime, the oxide of the same metal. No saline quality can be perceived in the soluble "*haloid salts*," so called by Berzelius, while free from water; and when a compound of this kind is moistened, even by contact with the tongue, it may be considered as a salt formed of an hydracid and an oxybase, produced by a union of the hydrogen of the water with the halogene element, and of the oxygen with the radical. It is admitted by Berzelius, vol. 3, page 330, that it cannot be demonstrated that the elements of the water, and those of an haloid salt, dissolved in that liquid, do not exist in the state

of an hydracid and an oxybase, forming a salt by their obvious union.

On the other hand, if, instead of qualities, we resort to composition as the criterion of a salt; if, as in some of the most respectable chemical treatises, we assume that the word salt is to be employed only to designate compounds consisting of a base united with an acid, we exclude from the class chloride of sodium, and all other "haloid salts," and thus overset the basis of the distinction between "*halogene*" and "*amphigene*" elements.

Moreover, while thus excluding from the class of salts, substances which the mass of mankind will still consider as belonging to it, we assemble under one name combinations opposite in their properties, and destitute of the qualities usually deemed indispensable to the class. Thus under the definition that every compound of an acid and a base, is a salt, we must attach this name to marble, gypsum, felspar, glass, and porcelain, in common with Epsom salt, Glauber's salt, vitriolated tartar, pearlash, &c. But admitting that these objections are not sufficient to demonstrate the absurdity of defining a salt, as a compound of an acid and a base, of what use could such a definition be, when, as I have premised, it is quite uncertain what is an acid, or what is a base. To the word acid, different meanings have been attached at different periods. The original characteristic sourness, is no longer deemed essential! Nor is the effect upon vegetable colours treated as an indispensable characteristic. And as respects obvious properties, can there be a greater discordancy, than that which exist between sulphuric acid, and rock crystal; between vinegar, and tannin; or between the volatile, odoriferous, liquid, poison, which we call prussic acid, and the inodorous, inert, concrete, material for candles called margaric acid?

While an acid is defined to be a compound capable of forming a salt with a base, a base is defined to be a compound, that will form a salt with an acid. Yet a salt is to be recognised as such, by being a compound of the acid and base, to which, as I have stated, it is made an essential mean of recognition.

An attempt to reconcile the definitions of acidity given by Berzelius, with the sense in which he uses the word acid, will in my apprehension, increase the perplexity.

It is alleged in his *Traité*, page 1, Vol. II, "*that the name of acid is given to silica, and other feeble acids, because they are susceptible of combining with the oxides of the electropositive metals, that is to say, with salifiable bases, and thus to produce salts, which is precisely the principal character of acids.*" Again, Vol. I, page 308, speaking of the *halogene* elements, he declares that "their combinations with hydrogen, are not only acids, but belong to a series the most puissant that we can employ in Chemistry; and in this respect they rank as equals with the strongest of the acids, into which oxygen enters as a constituent principle." And again, Vol. II, page 162, when treating of hydracids formed with the *halogene* class, he alleges "*The former are very powerful acids, truly acids, and perfectly like the oxacids; but they*

do not combine with salifiable bases; on the contrary, they decompose them, and produce haloid salts."

In this paragraph, the acids in question are represented as pre-eminently endowed with the attributes of acidity, while at the same time they are alleged to be destitute of his "*principal character of acids*," the property of combining with salifiable bases.

In page 41, (same volume) treating of the acid consisting of two volumes of oxygen and one of nitrogen, considered by chemists generally as a distinct acid, Berzelius uses the following language. "If I have not coincided in their view, it is because, judging by what we know at present, the acid in question cannot combine with any base, either directly or indirectly, that consequently it does not give salts, and that salifiable bases decompose it always into nitrous acid,* and nitric oxide gas. It is not then a distinct acid, and as such, ought not to be admitted in the nomenclature." Viewing these passages with all that deference which I feel for the productions of the author, I am unable to understand upon what principle the exclusion of nitrous acid from the class of acids, can be rendered consistent with the retention, in that class, of the compounds formed by hydrogen with "*halogene*" elements.

Having thus endeavoured to show that the words acid, salt, and base, have not been so defined as to justify their employment as the basis of the Berzelian nomenclature, I will with great deference proceed to state my objections to the superstructure, erected upon this questionable foundation. Consistently with the French nomenclature, the combinations formed by electronegative principles, with other elements, have been distinguished as *acids*, or characterized by a termination in "*ide*," or in "*ure*," which last monosyllable, when there has been no intention of altering the meaning, has, by the British chemists, been translated into *uret*. The termination in *ide*, which is common to both languages, is, by Thenard, and other eminent French authors, restricted to the binary compounds of oxygen, which are not acid. Analogous compounds formed with the "*halogene*" elements, chlorine, bromine, fluorine, iodine, cyanogen, &c., have by the same writer been designated by the termination in *ure*. Thus we have in his work, chlorures, bromures, fluorures, iodures, cyanures. Some of the most eminent chemists in Great Britain, have distinguished the elements called halogene, by Berzelius, together with oxygen, as supporters of combustion; and have designated the binary compounds made with them, when not acid, by the same termination as the analogous compounds of oxygen. Accordingly in their writings, instead of the names above mentioned, we have chlorides, bromides, fluorides, iodides. In Henry's Chemistry, cyanure is represented by cyanide; in Thomson's, by cyanodide, and in Brande's and Turner's, by cyanuret.

The term *uret*, equivalent as above mentioned to the French *ure*, is restricted by the English chemists to the compounds form-

* Hyponitrous acid of other chemists.

ed by non-metallic combustibles, either with each other, or with metals. Hence we have in English, sulphurets, phosphurets, carburets, borurets, for sulphures, phosphures, carbures, borures, in French.

Berzelius classes as electronegative, "all those substances which go to the positive pole when isolated, or *when in union with oxygen*," while all substances are by him treated as electropositive which go to the negative pole, either when isolated, or when in union with oxygen.*

According to his nomenclature, when both the ingredients in a binary compound belong to the class of bodies, by him designated as electronegative, the termination in *ide*, is to be applied to the more electronegative ingredient; but where one of the ingredients belongs to his list of electropositive bodies, the termination in *ure*, (*uret*, in English) is to be applied to the electronegative ingredient. As, agreeably to the prevailing nomenclature, which in this respect, the great Swedish chemist has not deemed it expedient to change, the electropositive compounds of oxygen with radicals, forming electropositive bases, have each a termination in *ide*, it seems that consistency requires us, conformably with the English practice, to designate in like manner analogous electropositive compounds of the electronegative elements called by him "*halogene*." But especially it would be inconsistent not to put the same mark upon the compounds of substances which from their analogy with oxygen are placed in the same "*amphigene*" class. If there were insuperable reasons for retaining the term *oxide*, as a generic name for the electropositive compounds of oxygen, it seems to me inexpedient not to employ the words *sulphide*, *selenide*, and *telluride*, to designate the electropositive compounds of sulphur, selenium, and tellurium. And since the three last mentioned elements when united with hydrogen, form electronegative compounds which act as acids, why not treat them as such, under appellations corresponding with those heretofore used for that purpose?

I conceive the following definitions to be justified by the practice of modern chemists in general, as established in the case of oxacids and oxibases. *When two compounds capable of combining with each other to form a tertium quid, have an ingredient common to both, and one of the compounds prefers the positive, the other the negative pole of the voltaic series, we must deem the former an acid, the latter a base* And again, all compounds

* The term *isolated*, is employed to convey an idea of the state in which the elements of water are, when after having been separated by the voltaic wires, they are severally on their way to their appropriate poles, that is, the oxygen proceeding to the positive pole, and the hydrogen to the negative pole. Each element is in that case isolated, and obedient to the attractive influence of one of the poles. When a salt containing an oxacid and an oxybase, is decomposed, the acid will go to the positive, and the base to the negative pole. The radical of the acid, in consequence of its not counteracting the propensity of the oxygen for the positive pole, is deemed electronegative; while the radical of the base overcoming that propensity, is deemed electropositive.

having a sour taste, or which redden litmus, should be deemed acids in obedience to usage.

I should think it preferable, if in adopting these definitions, the termination in *ide* was considered as applicable to all compounds of electronegative principles with other substances, whether producing electronegative or electropositive combinations, and that the terms acid, and base, should be considered as severally indicating the subordinate electronegative, and electropositive compounds. In that case oxybase, chloribase, fluobase, bromibase, iodobase, cyanobase, sulphobase, telluribase, selenibase, would stand in opposition to oxacid, chloracid, fluacid, bromacid, iodacid, cyanacid, sulphacid, silenacid, telluracid; yet for convenience, the generic termination *ide* might be used without any misunderstanding; and so far, the prevailing practice might remain unchanged. Resort to either appellation would not, agreeably to custom, be necessary in speaking of salts or other compounds analogous to them; since it is deemed sufficient to mention the radical as if it existed in the compound in its metallic state. Ordinarily we say, sulphate of lead, not sulphate of the oxide of lead. This last mentioned expression is resorted to, only where great precision is desirable. In such cases, it might be better to say sulphate of the oxybase of lead. So long however as the electronegative combinations of oxygen are designated as oxacids, and the electropositive as oxides, it seems to be incorrect, not to use analogical terms in the case of analogous compounds, formed by the other pre-eminently electronegative principles; and assuming the definition above stated, to be justified by modern practice, it follows, that in order to entitle the electronegative and electropositive ingredients of the double salts of Berzelius, to be classed, the latter as bases, and the former as acids, it is not necessary to appeal to the highly interesting and important experiments of Bonsdorf, confirmed in some instances by the testimony of Berzelius himself, proving that the attributes of acidity exist in the one case, and those of alkalinity in the other. My definition is founded upon the conviction that these characteristics have not latterly been deemed necessary to acids, and that in bases, they never were required; having, as respects them, only served as a means of subdivision, between alkaline oxides and other bases.

Chemistry owes to Berzelius much valuable information respecting the compounds formed by the substances which he calls "*halogene*," especially respecting the combinations formed by fluorine, with boron, and silicon, and the "*double salts*," as he considers them, formed by "*fluorides*" and "*fluorures*," and "*chlorides*" and "*chlorures*," &c. While in the highest degree interested in the facts which he has ascertained, it will be inferred from the premises, that I do not perceive that any adequate line of distinction can be drawn in this respect between his *double salts* of the "*halogene*" elements, and the simple salts formed by oxacids and oxybases.—Agreeably to the definition which I have ventured to propose, his *chlorides*, and *fluorides*, should be *chloracids* and *flu-*

acids; his *chlorures*, and *fluorures*, should be either *chlorides* and *fluorides*, or *chloribases* and *fluobases*.

In common with other eminent chemists, he has distinguished acids in which oxygen is the electronegative principle, as *oxacids*, and those in which hydrogen is a prominent ingredient as *hydracids*. If we look for the word radical, in the table of contents of his invaluable Treatise, we are referred to p. 218, vol. 1st., where we find the following definition, "*the combustible body contained in an acid, or in a salifiable base, is called the radical of the acid, or of the base.*"—In the second vol. page 163, he defines hydracids to be "those acids, which contain an electronegative body, combined with hydrogen;" and in the next page it is stated, that "hydracids are divided into those which have a simple radical, and those which have a compound radical. The second only comprises those formed with cyanogen and sulphocyanogen." Again, in the next paragraph, "no radical is known that gives more than one acid with hydrogen, although sulphur and iodine, are capable of combining with it in many proportions. If at any future day more numerous degrees of acidification with hydrogen, should be discovered, their denomination might be founded on the same principles as those of oxacids." Consistently with these quotations, all the electronegative elements forming acids with hydrogen, are radicals, and of course by his own definition, combustibles; while hydrogen is made to rank with oxygen as an acidifying principle, and consequently is neither a radical nor a combustible. Yet page 189, vol. 2d, in explaining the reaction of fluoboric acid with water, in which case, fluorine unites both with hydrogen and boron, it is mentioned as one instance among others in which fluorine combines with *two combustibles*.

I am of opinion that the employment of the word hydracid, as co-ordinate with oxacid, must tend to convey that erroneous idea, with which, in opposition to his own definition, the author seems to have been imbued, that hydrogen in the one class, plays the same part as oxygen in the other. But in reality, the former is eminently a combustible, and of course the radical, by his own definition.

Dr. Thomson, in his system, does not recognise any class of acids, under the appellation of hydracids; but with greater propriety, as I conceive, places them under names indicating their electronegative principles. Thus he arranges them as oxygen acids, chlorine acids, bromine acids, iodine acids, fluorine acids, cyanogen acids, sulphur acids, selenium acids, and tellurium acids.* Those appellations might, I think, be advantageously abbreviated into oxacids, chloracids, fluacids, bromacids, iodacids, cyanacids, sulphacids, selenacids, telluracids.

As respects the acids individually, I conceive that it would be preferable, if the syllable indicating the more electronegative ele-

* I had formed my opinions on this subject, before I was aware that Dr. Thomson had resorted to this classification.

ment had precedence in all, as it has in some cases. The word hydrofluoric does not harmonize with fluoboric, fluosilicic, fluochromic, fluomolybdic, &c. Fluorine being in each compound the electronegative principle, the syllables indicating its presence, should in each name occupy the same station. These remarks will apply, in the case of acids formed with hydrogen, by all principles which are more electronegative. Hence we should use the terms chlorohydric, fluohydric, bromohydric, iodohydric, cyanhydric, instead of hydrochloric, hydrofluoric, hydrobromic, hydriodic, hydrocyanic.

These opinions, conceived last summer, were published by me in the *Journal of Pharmacy* for October last. Since then, I find that in the late edition of his *Traité*, Thenard has actually employed the appellations above recommended.

As by the British chemists the objectionable words have not been definitively adopted; the appellations muriatic and prussic, being still much employed, it may not be inconvenient to them to introduce those which are recommended by consistency. In accordance with the premises, the acids formed with hydrogen by sulphur, selenium, and tellurium, would be called severally sulphydric, selenhydric, and telluhydric acid. Compounds formed by the union of the acids thus designated, with the bases severally generated by the same electronegative principles, would be called sulphhydrates, selenhydrates, and telluhydrates, which are the names given to these compounds in the Berzelian nomenclature. Influenced by the analogy, a student would expect the electronegative ingredient of a sulphhydrate to be sulphydric acid, not a sulphide. The terminating syllable of this word, by its associations, can only convey the conception of an electropositive compound.

By adhering to the plan of designating each acid by its most electronegative ingredient, the compounds of hydrogen and silicon, or of hydrogen and boron with fluorine, would appear in a much more consistent dress. In the compound named hydrofluoboric acid, and that named hydrofluosilicic acid by Berzelius, fluorine is represented as acting as a radical with hydrogen, while with boron and silicon it acts as the electronegative principle. It has been shown that hydrogen, no less than boron and silicon, must be considered as a combustible, and of course a radical. This being admitted, if the compounds in question are really entitled to be considered as distinct acids, their names should respectively be fluohydroboric, or fluohydrosilicic acid. But as I have elsewhere observed an incapacity to combine with bases, or to react with them without decomposition, is made by Berzelius an adequate reason for expunging the compound formed by one atom of nitrogen with four atoms of oxygen from the list of the acids of nitrogen. I do not, therefore, understand how the compounds referred to, while equally incapable of combination, can be considered by him as acids. At first it struck me that the liquids consisting of fluohydric acid, either with fluoboric acid, or with fluosilicic acid, might be considered as merely united by their common attraction to

water, since they separate when this liquid is abstracted by evaporation. Upon reflection, however, I retract that opinion, since it appears to me that if the compounds in question are to be considered as acids, they may be viewed satisfactorily as fluacids with a double radical; but I deem it more consistent to suppose that a fluobase of hydrogen in the one case unites with fluoboric acid, in the other, with fluosilicic acid; so that fluohydroboric acid might be called fluoborate of the fluobase of hydrogen, or more briefly fluoborate of hydrogen; and in like manner fluohydrosilicic acid would be called fluosilicate of the fluobase of hydrogen, or briefly fluosilicate of hydrogen.

There are instances in which compounds, usually called bases, act as acids. Of course it is consistent that compounds, usually called acids, should in some instances act as bases. In this respect a striking analogy may be observed between the union of the oxide of hydrogen (water) with the oxacids and oxybases; and that of fluoride of hydrogen with fluacids and fluobases. According to Berzelius, water, in the first case, acts as a base, in the second as an acid. So I conceive the fluoride of hydrogen acts as a base in the cases above noticed, while it acts as an acid in the compound of hydrogen, fluorine, and potassium, called by Berzelius "*fluorure potassique acide*." This compound I would call a fluohydrate of the fluobase of potassium, or more briefly fluohydrate of potassium, as we say sulphate of copper, instead of the sulphate of the oxide (or oxybase) of copper. It appears from the inquiries of the author of the nomenclature under consideration, that each of the three acids abovementioned as formed by fluorine, with the three different radicals, hydrogen, boron, and silicon, is capable, with electropositive metallic fluorides, of forming the compounds treated of by him as double salts. These compounds, to which I have already alluded, might be called fluohydrates, fluoborates, or fluosilicates of the metallic ingredient. As for instance, the compound into which potassium enters, named by him "*fluorure borico potassique*," I would designate as a fluoborate of the fluoride (or fluobase) of potassium, or for the sake of brevity, fluoborate of potassium. "*Fluorure silico potassique*," would by the same rule, be called fluosilicate of potassium.

The illustration thus given in the instance of potassium, renders it unnecessary to furnish other examples, as it would only require that the name of any other metal should be substituted for that of potassium, in order to modify these appellations, so as to suit every case.

Pursuant to my fundamental definition, ferropotassiate of potash, cyanure ferroso potassique in the Berzelian nomenclature, should be considered as a compound of cyanoferric acid, and a cyanide or cyanobase of potassium, and would of consequence be a cyanoferrate of potassium. Or if the iron be in two different degrees united with cyanogen, as the names cyanure ferroso potassique, and cyanure ferrico potassique indicate, we should have both a cyanoferrite and a cyanoferrate of potassium; and of course cyano-

ferrous and cyanoferric acid for their respective electronegative ingredients. "Cyanure ferrique acide" would be exchanged for cyanoferrate of hydrogen, being a case analogous to that of the "fluorure potassique acide" above considered and provided for.

If I am justified in my impression above stated, water, and the compound formed by fluorine with hydrogen ("hydrofluoric acid" or fluohydric acid as I prefer to call it) should be severally designated as acids when they act as acids; as bases, when they act as bases. In other cases the one might be designated as an oxide, the other as a fluoride, of hydrogen. In the case of a compound so well known as water, I would adhere to the common name, resorting to the scientific names only as definitions. Thus water would be defined as an oxide of hydrogen, which in some combinations, acts as an oxybase of hydrogen, in others as hydric acid, or the oxacid of hydrogen.*

After designating as metalloids all non-metallic bodies, Berzelius alleges (page 203, vol. 1st,) that they are divided into oxygen, and bodies which are *combustible*, or *susceptible of combining with oxygen*; in which process the greater part display the ordinary phenomena of combustion, or, in other words, of fire. Agreeably to this classification, susceptibility of union with oxygen and combustibility are confounded; to which I object, because oxidizement frequently ensues without combustion, and combustion occurs often without oxidizement.

Speaking of chlorine, (Traité, p. 276, vol. 1st,) it is alleged that it supports the combustion of a great number of bodies, of which a majority ignite in it at ordinary temperatures. If oxidizement be identical with combustion, how can this word be employed with propriety in the case thus quoted, where oxygen is not present? If combustion in the case of chlorine is applied only to those instances in which reaction with other bodies is attended by the phenomena of fire, why is not the term equally restricted in its application in the case of oxygen?

Oxygen differs so far from the substances usually called combustibles, that they will produce fire with oxygen, and with but few, if any other substances; while oxygen will produce fire with many substances. But this characteristic of producing fire with many substances, applies to chlorine, and as chlorine does not produce fire with oxygen, it is devoid of the only characteristic which should entitle it to be treated as a combustible, if combustibility and susceptibility of union with oxygen be identical.

Hence, if it be deemed proper in the case of oxygen to place the bodies with which it enters into combustion in one class, designated as combustibles, while oxygen is distinguished as the common "*comburant*" of them all, there is equal reason for placing

* The use which I have made of the terminations in ide, in fluoride of hydrogen, or oxide of hydrogen, to signify a compound of hydrogen with fluorine, or oxygen generally, without conveying the idea of its being either a base or an acid, illustrates the advantage which would result from the use of that termination in that broad sense.

chlorine in a like predicament. The impropriety of designating the substances comprised in his halogene and amphigene classes, with the exception of oxygen as combustibles, upon the basis of their susceptibility of oxidizement, must be evident from the fact, that fluorine is not oxidizeable, while it is so perfectly analogous to the others, especially chlorine, in its properties, that it would be disadvantageous to class it apart.

Berzelius objects to the use of the word "*comburant*," (equivalent to the English word supporter) upon the ground that the same substance may alternately be a supporter and a combustible. I should, however, go farther, and likewise object to the use of both words, as tending to convey the erroneous impression, that in combustion, one of the ponderable agents concerned, performs a part more active than the other; whereas, in all such cases, the reaction must evidently be reciprocal and equal. I have repeatedly shown to my pupils, that a jet of oxygen burns in an atmosphere of hydrogen, as well as a jet of hydrogen similarly situated in oxygen.

I would recommend that all the bodies comprised in the halogene and amphigene classes of Berzelius, should be placed under one head, to be called the Basacigen class; indicating their common and distinguishing quality agreeably to the premises, of producing both acids and bases. The electronegative compounds of these substances to be called acids, their electropositive compounds, bases, as already suggested.

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